National Aeronautics and Space Administration

technology opportunity

Discover the Power of Fiber Optic Sensing

NASA Armstrong's fiber optic sensing technologies offer a wealth of flexible options for a wide variety of applications

Armstrong's portfolio of fiber optic sensing technologies offers unparalleled options for high-resolution sensing in applications that require a unique combination of high-powered processing and lightweight, flexible, and robust sensors. Whether you want to monitor any one of a wide variety of parameters such as shape, strain, temperature, liquid level — or a combination of any of the above — Armstrong's technologies have the potential to do it better, faster and smarter that other products currently available.

Competitive Advantage

Armstrong's approach employs fiber Bragg grating (FBG) sensors and optical frequency domain reflectometry (OFDR) sensing. The novel system not only offers enormous advantages over traditional strain measurement systems, but it also provides unique advantages not available in other fiber optic sensing approaches:

- **Thousands of sensors on a single strand:** Sensors can be placed at such close intervals and in previously inaccessible regions (e.g., within bolted joints, embedded in a composite structure), enabling much more precise, high-resolution measurements than ever before
- **High-resolution visualization:** Enables users to zero in on high activity areas for instantaneous analysis of the desired parameters, including shape, temperature fluctuations, pressure, strength, etc.
- **Powerful processing:** Algorithms allow for rapid processing of data, enabling real-time analysis; system can achieve an ultra-fast refresh rate of 100 scans per second
- **3D shape determination:** By combining data from multiple fibers, the technology can provide three-dimensional visualization of shape and strain
- **Smart sensing:** System can be configured to automatically zero in on locations of high activity, enabling engineers to quickly focus on critical data points

Applications

Engineers are continually seeking new ways of looking at information and determining what is important. Armstrong's fiber optic sensing system focuses on critical data the researcher needs. Whether it is used to determine shape, stress, temperature, pressure, strength, operational load, or liquid level, Armstrong's technology offers ultra-fast, reliable measurements.

Shape Sensing

- **Medical:** The technology has the potential to be used for endoscopic surgery to ensure precise placement of the tiniest catheters. It can be used not only to track where the catheter is placed within the body but also to sense the shape of the catheter as it is moved.
- **Wind Energy:** By monitoring blade shape and force, Armstrong's fiber optic system has the potential to improve efficiency and longevity for wind turbines.
- **Aeronautics:** Originally developed to measure strain on unmanned aerial vehicles and aircraft, the technology enables immediate feedback in the event of aircraft wing deformation to allow for precise, controlled monitoring to help avoid adverse scenarios.

Liquid Level Sensing

- **Industrial, Pharmaceutical, and Cryogenic Applications:** Armstrong's technology provides a quick, easy, and accurate method to measure liquid level in vats of chemicals, cryogenic liquids, fuel, water, oil, alcohol, etc.

Temperature/Pressure

- **Drilling:** Armstrong's fiber optics have the potential to be used in specialized drill heads to sense drill direction as well as temperature and pressure. A drill operator needs to know exactly how a drill head is positioned, and this can be determined by knowing its shape. Temperature and pressure can also inform the operator about the health of the drill.

Shape, Stress, Temperature, Pressure, Load, Liquid Level

- **Aerospace launch vehicle:** The Armstrong fiber optic system allows multiple measurements to be determined all in a single system. For certain applications, such as aerospace launch vehicles, access to comprehensive data through a single system dramatically simplifies the health monitoring process.

Patents

NASA has two patents issued for this technology portfolio and is pursuing patent protection for seven additional innovations within the fiber optic sensor portfolio.

Licensing and Partnering Opportunities

NASA invites companies across all industries to explore opportunities to leverage these unique technologies to achieve their corporate objectives. Armstrong's team of cutting-edge researchers is actively seeking partners who are interested in developing and licensing technologies within this portfolio, many of which are patented or patent pending. Partners will have access to Armstrong's strong research support infrastructure and proven expertise with these sensing technologies.

For more information about this technology, please contact:

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